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[54] DRILL STRING TORQUE COUPLING AND METHOD FOR MAKING UP AND BREAKING OUT DRILL STRING CONNECTIONS

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[51] **Int. Cl.**[5] **B23P 19/00**

[52] **U.S. Cl.** **29/426.6**; 29/426.1; 29/426.5; 29/428; 175/85; 285/140; 285/333; 285/334.2

[58] **Field of Search** 29/426.1, 426.5, 428, 29/426.6; 175/85; 166/77.5; 285/140, 333, 334.2, 341

[56] **References Cited**

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3,866,954	2/1975	Slator et al.	285/333
4,534,585	8/1985	Saliger	285/333
4,658,915	4/1987	Goris et al.	175/57
4,830,121	5/1989	Krasnov et al.	175/57
4,875,529	10/1989	Wetch et al.	173/163

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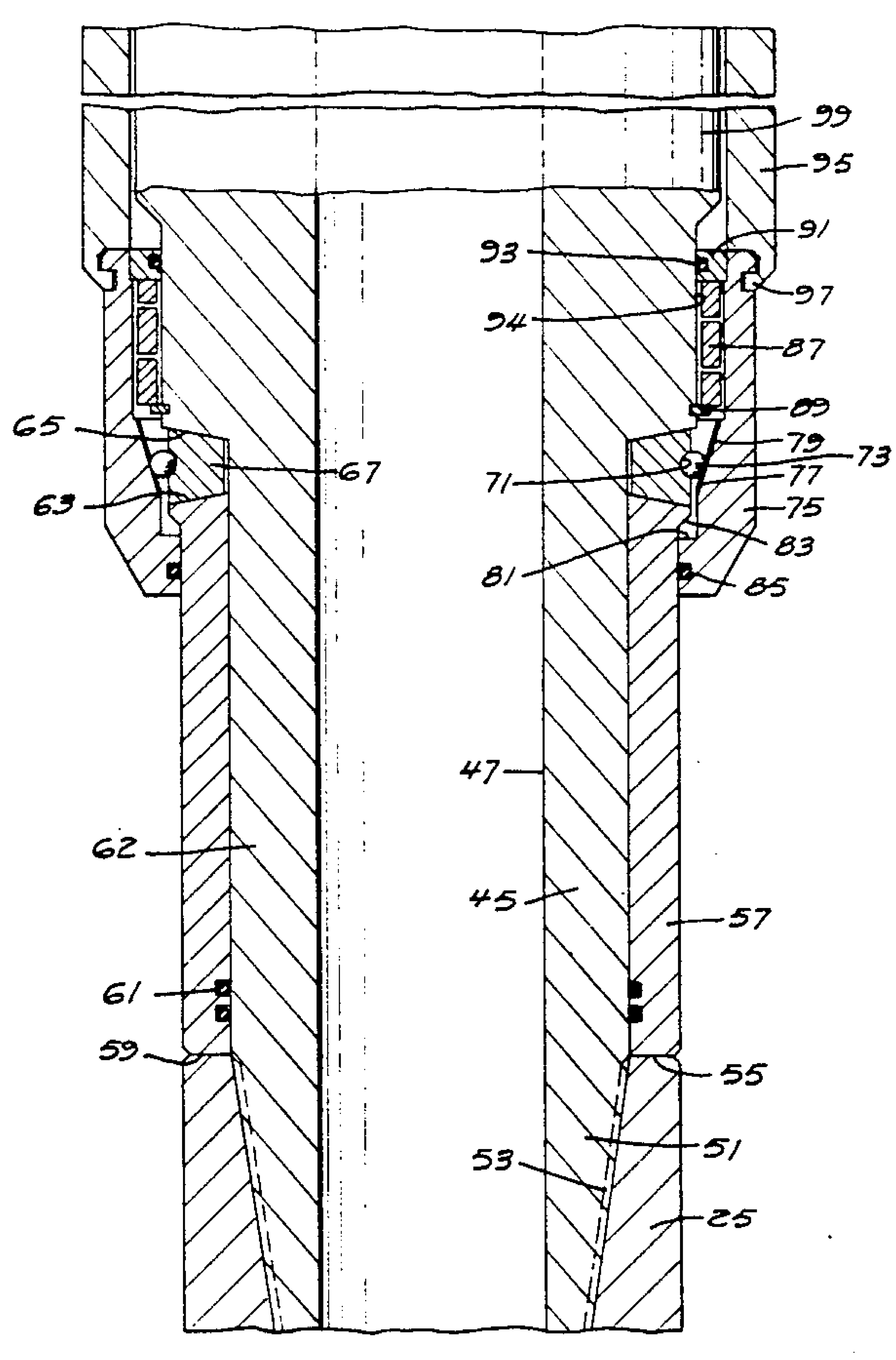
[57] **ABSTRACT**

A torque coupling for connecting between upper and lower tubular members of a drill rig allows make up and break out at lower torques than normally required. The coupling has a body which has an upper end that connects to the upper tubular member and lower end which connects to the lower tubular member. The lower tubular member has an upward facing torque shoulder. A torque shoulder sleeve mounts slideably to the body. The torque shoulder sleeve has a downward facing shoulder that engages the torque shoulder of the lower tubular member. The body and the torque shoulder sleeve have opposed load shoulders, at least one of which is conical. A wedge member locates between these load shoulders. When the wedge member slides outward, it decreases the distance between the load shoulders and reduces the pressure of the lower end of the torque shoulder sleeve against the upper end of the lower tubular member.

20 Claims, 4 Drawing Sheets



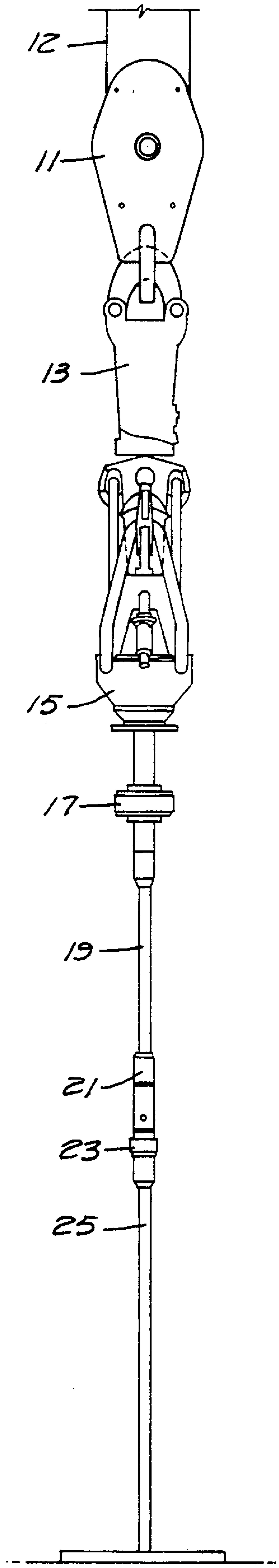


FIG. 1

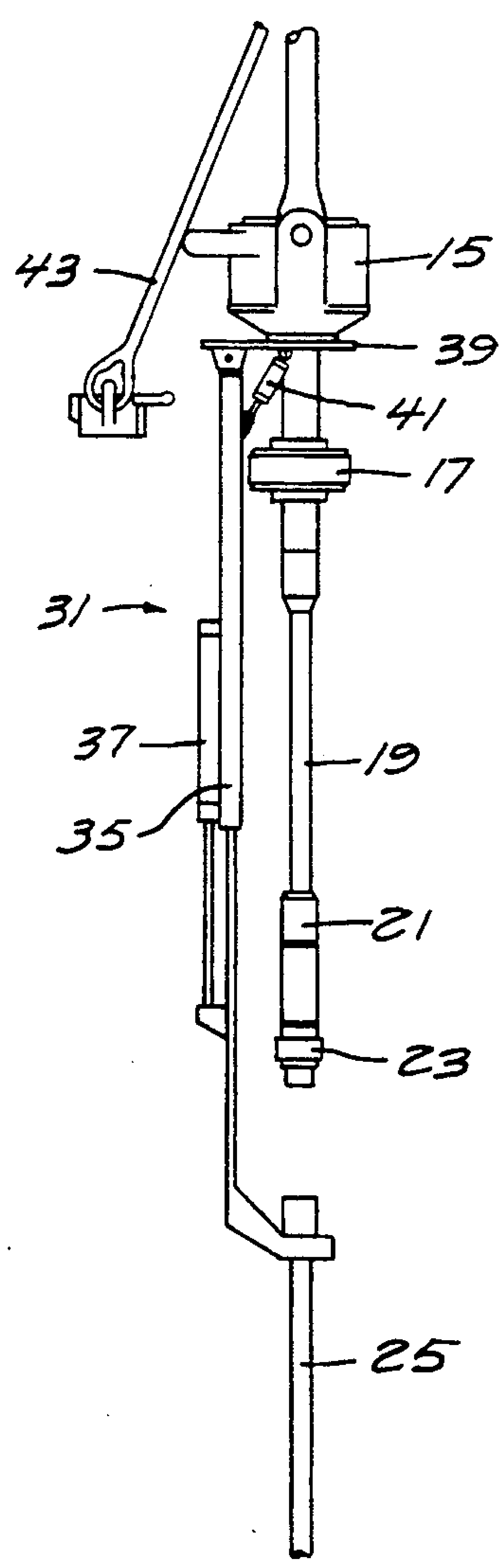


FIG. 2

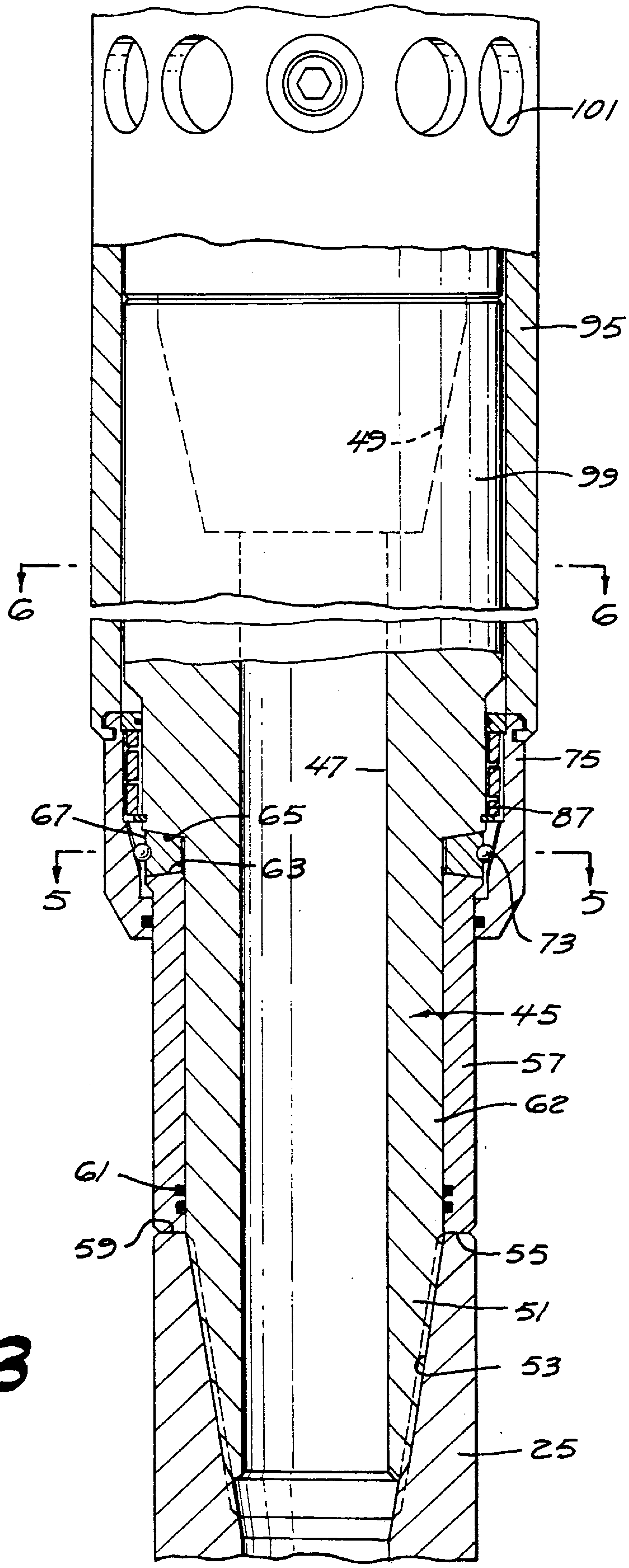


FIG. 3

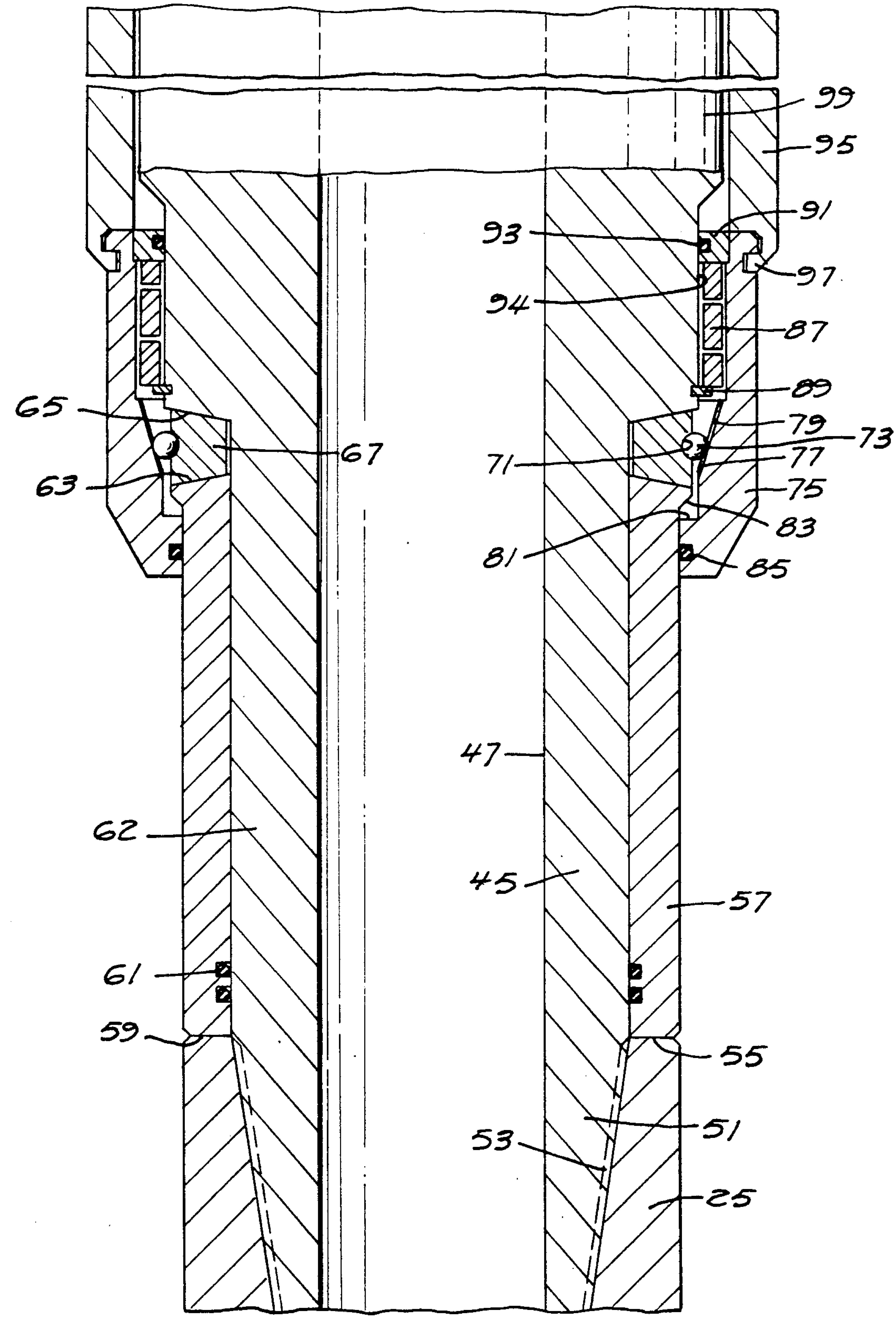

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FIG. 4

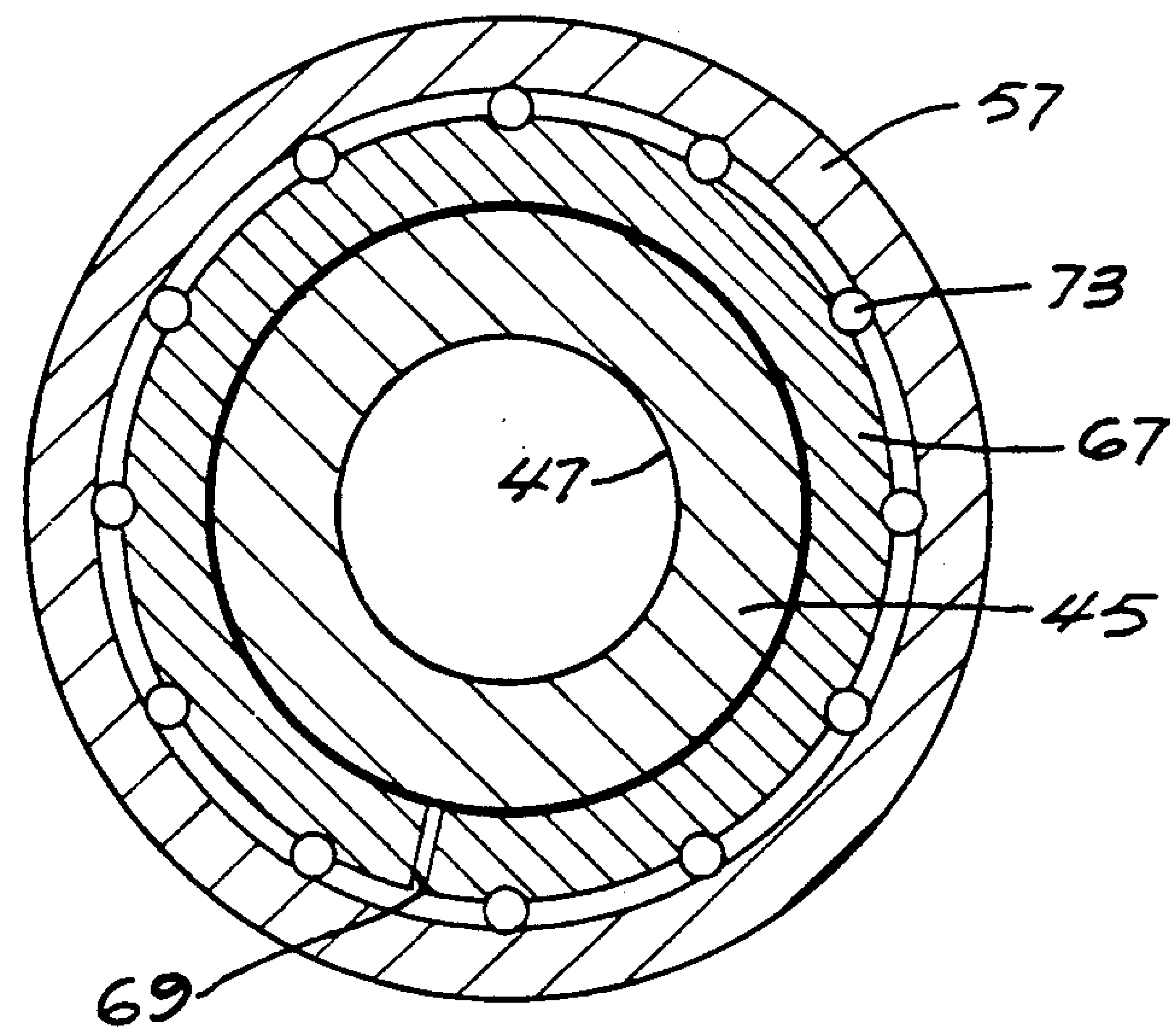

FIG. 5

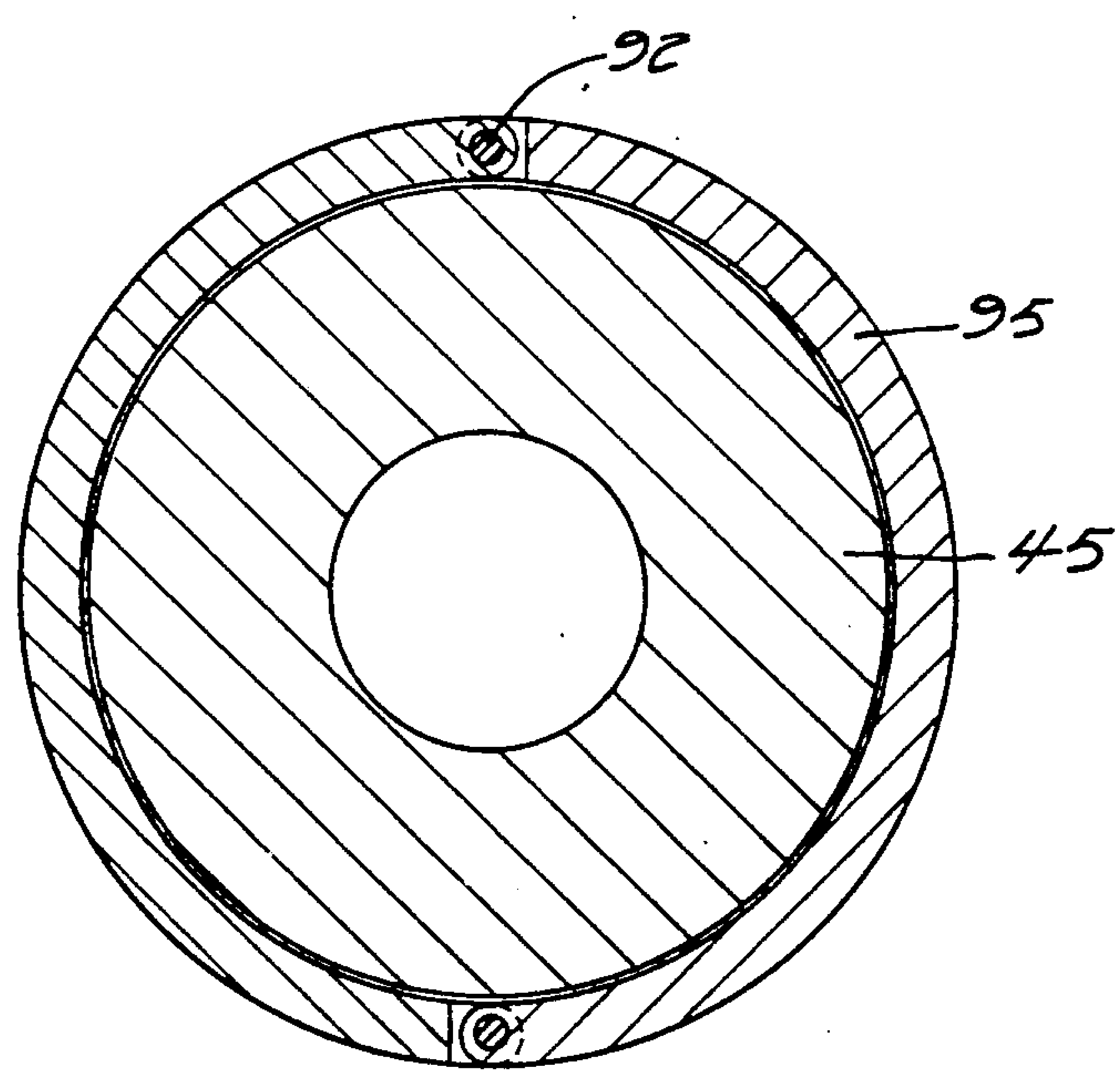

FIG. 6

DRILL STRING TORQUE COUPLING AND METHOD FOR MAKING UP AND BREAKING OUT DRILL STRING CONNECTIONS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates in general to oil and gas well drilling equipment, and in particular to a coupling device that connects into the upper end of the drill string to enable it to be broken out and made up with less torque than normally required.

2. Description of the Prior Art

In recent years, top and side drive oil and gas well drilling rigs have been commercially available. In these types of drilling rigs, drive equipment for rotating the drill pipe will be supported by the derrick. The drive assembly may be a top drive type as shown in U.S. Pat. No. 4,421,179. Or the drive assembly may be of a side drive type such as shown in U.S. Pat. No. 4,875,529. In both cases, a drive mechanism in the derrick will impart torque to the drill string.

Top and side drive drilling systems enable an operator to drill with a triple stand of pipe, rather than a single stand as with a kelly bushing type of drill rig. Particularly in the case of highly deviated wells, it enables a driller to ream as he is pulling out of and running into the hole. During reaming, the driller will rotate the pipe.

While reaming out of the hole, the top connection of each triple stand will be broken out high in the derrick. Also, if reaming while, going into the well, the top connection with the rotary drive spindle must be made up while high in the derrick. These operations require power make up and break out equipment in the derrick. If the make up and break out equipment does not have a back up, tongs must be employed on the rig floor for back up.

In U.S. Pat. No. 4,658,915, a coupling is shown for connection between the drive spindle and the top of a triple stand. This coupling will break out at a lower torque than making up. This avoids a need for a back up tong high in the derrick. Rather, the back up tong will be located at the rig floor, and the drive spindle will be rotated in reverse to break out the top connection. The break out torque, while lower, is still substantial.

SUMMARY OF THE INVENTION

In this invention, a torque coupling is employed between upper and lower tubular members in the drill string. The coupling makes up and breaks out with very little, if any, torque required. The coupling has a body which connects on its upper end to an upper tubular member of the drill string. The lower end is a pin for connection into the box of a lower tubular member. A torque shoulder sleeve will slide vertically on the exterior of the body. The torque shoulder sleeve has a torque shoulder which bears against the upward facing torque shoulder on the box of the lower tubular member.

The upper end of the torque shoulder sleeve has an upward facing load shoulder. The body has a downward facing load shoulder spaced above the upward facing load shoulder. At least one of these load shoulders is conical, so that the vertical distance between them increases from their inner diameters outward.

A wedge member locates between these load shoulders. The wedge member, when located in its inner position, tightly wedges the torque shoulder sleeve downward against the box torque shoulder. Moving the wedge member inward will apply a large preload force to the torque shoulders, providing a desired amount of make up torque.

Moving the wedge member outward will allow the distance to decrease between the upper end of the torque shoulder sleeve and the load shoulder of the body. This slight decrease in distance removes the preload at the torque shoulders to enable the connection to be easily broken out.

The wedge member is biased to the outer position. A retaining sleeve will hold the wedge member in the inner position until the retaining sleeve is moved vertically. When moved vertically to the released position, the wedge member springs outward to remove the preload force.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side, partially schematic view, of a portion of a drill rig having a torque coupling constructed according to this invention, and shown connected into a drill string.

FIG. **2** is a partial view of a pipe handling mechanism for connecting the upper end of the drill string to the torque coupling used in FIG. **1**.

FIG. **3** is an enlarged vertical sectional view of the torque coupling of FIG. **1**.

FIG. **4** is a further enlarged sectional view of a portion of the torque coupling of FIG. **3**.

FIG. **5** is a transverse sectional view of the torque coupling of FIG. **3**, taken along the line V—V of FIG. **3**.

FIG. **6** is transverse sectional view of the torque coupling of FIG. **3**, taken along the line VI—VI of FIG. **3**.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. **1**, the drilling rig will have blocks **11** suspended on cables **12**. A hook **13** locates below blocks **11**. The hook **13** will support a swivel **15** which allows the drill string to rotate relative to the blocks **11**.

In the drill rig shown in FIG. **1**, a power rotary drive **17** is shown suspended below the power swivel **15**. The rotary drive **17** schematically represents some type of rotary drive for rotating the drill string relative to the swivel **15**. This could be a side drive mechanism such as shown in U.S. Pat. No. 4,875,529 or a top drive mechanism such as shown in U.S. Pat. No. 4,421,179. If another type of rotary power is used for drilling, the rotary drive **17** could be a kelly spinner, which is capable of rotating a stand of drill pipe, but has little torque. The mechanism used to rotate the drill string could be of various types. For the purposes of this invention, rotary drive **17** need not be capable of making up or breaking out a conventional drill pipe joint to the desired make and break out torque. Rotary drive **17** need only be capable of rotating a tubular member at low torque.

A pup joint **19** extends below the rotary drive **17**. A kelly cock **21** connects to the lower end pup joint **19**. Kelly cock **21** is a valve for closing the inner passage of the drill string in case the fluid in the drill string starts blowing upward due to formation pressure being higher than the drilling fluid hydrostatic pressure. The kelly cock **21** can be manually operated or hydraulically or pneumatically powered.

A torque coupling **23** constructed in accordance with this invention locates below kelly cock **21**. Torque coupling **23** connects to the upper end of the uppermost section of drill pipe **25**. A slip assembly **27** is located at the rig floor to support the weight of the drill pipe **25** in the hole.

Referring to FIG. **2**, the drill rig will also have a pipe handler **31**. Pipe handler **31** will be employed to stab the upper end of a triple stand of drill pipe **25** into the torque coupling **23**. Pipe handler **31** may be of various types. In the embodiment shown, pipe handler **31** has a collar **33** which engages the upper end of the stand of drill pipe **25**. A telescoping arm **35** supports collar **33**. A hydraulic cylinder **37** will lift the collar **33** to cause the upper end of the drill pipe **25** to engage the lower end of the torque coupling **23**.

A flange **39** mounted to swivel **15** supports pipe handler **31**. A tilting cylinder **41** will enable the pipe handler **31** to be tilted out of alignment with torque coupling **23** while not used. A conventional elevator **43** also mounts to the hook **13** for tripping out of and into the hole when reaming is not utilized.

Referring to FIG. **3**, torque coupling **23** includes a tubular body **45**. Body **45** has an axial passage **47** extending through it. Threads **49** on the upper end serve as means for connecting the body **45** to an upper tubular member, which is the kelly cock **21** (FIG. **1**) in the preferred embodiment. Body **45** has a threaded pin **51** on its lower end. Pin **51** has conventional drill pipe threads for engaging box threads **53** on the upper end of the drill pipe **25**. The box threads **53** will conventionally have a torque shoulder **55** which is an external rim located on the upper end.

A torque shoulder sleeve **57** mounts to body **45**. Torque shoulder sleeve **57** is capable of slight vertical sliding movement relative to body **45**. A key or spline (not shown) prevents any rotation between torque shoulder sleeve **57** and body **45**. Torque shoulder sleeve **57** has a downward facing torque shoulder **59** that will engage the box torque shoulder **55**. It is necessary for the shoulders **59** and **55** to make up to a desired compressive load in order for the connections between the pin **51** and threads **53** to be fully made up. O-ring **61**, located on the interior lower end of the torque shoulder sleeve **57**, seals the torque shoulder sleeve **57** to the lower portion **62** of the body **45**.

The torque shoulder sleeve **57** has a load shoulder **63** on its upper end. Load shoulder **63** is frusto-conical. It inclines downward and outward at a slight inclination relative to a plane perpendicular to the axis of body passage **47**. The body **45** has a downward facing load shoulder **65** spaced a short distance above the load shoulder **63**. The body load shoulder **65** is also frusto-conical. However, it inclines upward and outward at a slight angle relative to a plane perpendicular to the axis of passage **47**. Preferably, the magnitudes of the angles of inclination of the load shoulders **63**, **65** are the same. The radial dimensions from the inner diameters to the outer diameters of the load shoulders **63**, **65** are the same. This results in an annular space between the shoulders **63**, **65** that has an increasing vertical dimension from the inner diameters of the load shoulders **63**, **65** outward. The vertical distance between the load shoulders **63**, **65** at the inner diameters will be less than the vertical distance between the load shoulders **63**, **65** at their outer diameters.

Referring to FIG. **4**, a wedge ring **67** locates in the annular space between the load shoulders **63**, **65**. Wedge ring **67** is a metal resilient member and has a split **69**, shown in FIG. **5**. Wedge ring **67** has an upper side or surface that is frusto-conical and which inclines at the same angle as the body load shoulder **65**. The lower side of wedge ring **67** is also frusto-conical and inclines at the same inclination as the sleeve load shoulder **63**.

The wedge ring **67** will move from an inner position, which is shown in FIGS. **3** and **4**, to an expanded outer position (not shown). The split **69** and the resiliency of the wedge ring **67** serves as a bias means to urge the wedge ring **67** from the contracted position to the outer expanded position. Unless restrained, the wedge ring **67** would spring outward to the expanded position, in which its outer diameter is radially beyond the outer diameters of the load shoulders **63**, **65**.

A retaining means is employed to selectively prevent the wedge ring **67** from springing out to the expanded position. This includes several concave recesses **71** spaced circumferentially around the outer diameter of the wedge ring **67**. Each recess **71** will hold a steel ball **73**. A retaining sleeve **75** locates on the exterior of the wedge ring **67**. The retaining sleeve **75** has an inclined surface in its interior. Inclined surface **77** is conical and extends from a smaller diameter on its lower extent to a larger diameter on its upper extent. The inclined surface **77** locates radially outward from wedge ring **67**. Vertical grooves **79** are formed in the incline surfaced **77** around the circumference of the inclined surface **77**. Each groove **79** is opposite one of the recesses **71**. Each ball **73** locates in one of the grooves **79**. Each ball **73** thus has one side located in a recess **71** and another side in a groove **79**.

The retaining sleeve **75** will move vertically relative to body **45** between an upper position, which is shown in FIGS. **3** and **4**, and a lower position, which is not shown. In the upper or locked position, the balls **73** locate about on the vertical center of the grooves **79**. The retaining sleeve **75** and the balls **73** prevent the wedge ring **67** from moving outward when in this locked position. When the retaining sleeve **75** moves downward to the unlocked position, the balls **73** will still be in the grooves **79**, but near the upper ends of the grooves **79**. The inclination of the grooves **79** allows the balls **73** and wedge ring **67** to move radially outward when moving to the unlocked position.

The retaining sleeve **75** has a lower lip **81** that extends inward and locates below a stop shoulder **83** on the retaining sleeve **75**. A seal **85** seals the lower lip **81** to the exterior of the retaining sleeve **75**. A coil spring **87** locates in the interior of the retaining sleeve **75** for urging the retaining sleeve **75** to remain in the locked position. Spring **87** has a lower end that bears against a snap ring **89** rigidly secured to body **45**. Spring **87** is compressed and has an upper end that engages a threaded retaining ring **91**. Retaining ring **91** threads to the inner diameter of the retaining sleeve **75** at its upper end. Spring **87** pushes upward on the retaining ring **91**.

Referring again to FIG. **4**, a seal **93** on the inside of retaining ring **91** seals the retaining ring **91** to a body intermediate portion **94**. Seals **61**, **85** and **93** prevent the entry of foreign material into the interior of the retaining sleeve **75**.

An extension sleeve **95** extends upward from retaining sleeve **75**. As shown in FIG. **6**, extension sleeve **95** is in two halves. Pins **92** connect the halves together. Extension sleeve **95** will move in unison with retaining sleeve **75**. A flange **97** on the lower end of the extension sleeve **95** connects the extension sleeve **95** to the retaining sleeve **75**. Extension sleeve **95** slides upon a body upper portion **99**. Holes **101** provide access to the kelly cock **21** (FIG. **1**) if necessary. The pins **92** allow the extension sleeve **95** to be quickly removed to apply tongs (not shown) to the upper body portion **99** if needed.

In operation, if it is desired to rotate the drill pipe **25** while pulling it from the hole, then rotary drive means will be employed as the blocks **11** pull the drill string **25** upward. Once a triple stand of three 30 foot sections of drill pipe **25** is above the slips **27**, then the slips **27** can be employed to support the drill string in the well. A worker in the derrick will guide the collar **33** of pipe handler **31** (FIG. **2**) into engagement with the upper end of the drill pipe **25**.

The retaining sleeve **75** (FIG. **3**) will be moved downward. This can be handled by the worker physically gripping the retaining sleeve **75** and pushing downward. Alternately, it can be handled by a mechanical actuator (not shown). When the retaining sleeve **75** moves downward, the balls **73** (FIG. **4**) will move along the grooves **79** as the inclined surface **77** moves downward. The balls **73** move radially outward as the inclined surface **77** moves downward. This allows the wedge ring **67** to move radially outward relative to the load shoulder **63, 65**. Movement of the wedge ring **67** outward causes the distance between the load shoulders **63, 65** to decrease slightly, perhaps only about 0.0001 inch. This removes the compressive force between the torque shoulders **55, 59**.

The rotary drive **17** will be rotated in reverse. This spins the body **45** to easily unscrew the pin **51** from the box threads **53**. Essentially no torque is required to break out the connection. Consequently, there is no need to provide a back up for the drill pipe **25** to react against break out torque. Once the retaining sleeve **75** is released from its lower position, the spring **87** will push the retaining sleeve **75** back up to its upper locked position shown in FIG. **4**.

The workers may then disconnect the lower connection of the triple stand of drill pipe **25** above the slips **27** in a conventional manner using tongs. The driller and the derrick man will then place the triple stand of drill pipe **25** in a storage position in the derrick. The driller pivots the pipe handler **31** (FIG. **2**) out of the way and lowers the blocks **11** until the torque coupling **23** locates on the upper end of the drill pipe **25** supported by the slip assembly **27**.

To connect the torque coupling **23** to the drill pipe **25** while torque coupling **23** is located near the rig floor, a rig floor worker will push the retaining sleeve **75** back downward. The wedge ring **67** will move radially outward a short distance. The rotary drive **17** will be employed to spin the body **45** to an initial make up of the pin **51** with the box threads **53**. The rotational movement will stop once the shoulders **55** and **59** contact each other. High torque is not necessary.

The retaining sleeve **75** will then be moved back to the upper position. When moved to the upper position, retaining sleeve **75** will force the balls **73** back inward, pushing the wedge ring **67** tightly between the load shoulders **63, 65**. This applies a compressive force acting through the torque shoulder sleeve **57** to the torque shoulder **55**. This will make up the connection without the need for high rotational torque equipment. The driller will then release the slips **27** and pull the drill string **25** again from the well while rotating using a rotational drive means. The operation described above will be repeated.

If it is desired to ream while running into the well, the connection of the torque coupling **23** to the drill pipe **25** must be made up in the derrick. This will be handled while utilizing the pipe handler **31**. The derrick worker will place the upper end of a stand of drill pipe **25** in the collar **33**. The driller will actuate the hydraulic cylinder **37** (FIG. **2**) and pull the stand of drill pipe **25** up into engagement with the torque coupling **23**.

The derrick worker will pull the retaining sleeve downward (FIG. **4**). The rotary drive **17** will be actuated to spin the torque coupling **23** until the torque shoulders **55, 59** contact each other. No rotational torque is required, and no back up on the drill pipe **25** is needed. The worker then will allow the retaining sleeve **75** to spring back upward. The retaining sleeve **75** will force the wedge ring **67** back inward, preloading the connection to the desired compressive load between shoulders **55, 59**. The driller will then move the pipe handler **31** out of the way using the hydraulic cylinder **41** (FIG. **2**). The driller then rotates the drill pipe **25** and lowers the drill string into the well during this rotation.

The elevators **43** may be used for conventional tripping into and out of the well while not reaming. During this operation, the swivel **15**, rotary drive **17** and torque coupling **23** will be set aside. During normal drilling, a triple stand will normally be previously made up and connected into the drill string **25** in the manner previously described.

If a pressure kick occurs, the kelly cock **21** can be manually closed. The pup joint **19** and swivel **15** can be disconnected from the kelly cock **21** (FIG. **1**). To do so, the workers will remove one of the pins **92** (FIG. **6**). This enables the extension sleeve **95** to be removed. Conventional tongs can then be placed on the upper portion **99** of body **45** and on the pup joint **19** to unscrew the pup joint **19** from the kelly cock **21**.

The invention has significant advantages. The torque coupling enables a joint to be broken out and made up with essentially no torque required. The torque coupling allows one to utilize a drilling system without the need for power tongs in the derrick. It allows the make up and break out of connections in the derrick without the need for back up tongs at the rig floor.

While the invention has been shown in only one of its forms, it should be apparent to those skilled in the art that it is not so limited but susceptible to various changes without departing from the scope of the invention.

I claim:

1. A torque coupling for connection between upper and lower tubular members, the lower tubular member having an internally threaded box with an upward facing torque shoulder on its upper end, the torque coupling comprising in combination:

a body having a vertical axis and a lower end with an externally threaded pin for connection to the box of the lower tubular member;

connection means on an upper end of the body for connecting the body to the upper tubular member;

a torque shoulder sleeve mounted to the exterior of the body and having a downward facing torque shoulder for engaging the torque shoulder of the box;

the torque shoulder sleeve having an upper end with an upward facing load shoulder;

the body having a downward facing load shoulder spaced above the load shoulder of the torque shoulder sleeve, at least one of the load shoulder being conical, providing a greater vertical distance between the load shoulders at outer peripheries of the load shoulders than at inner peripheries of the load shoulders;

a wedge member carried between the downward facing load shoulder of the body and the upward facing load shoulder of the torque shoulder sleeve, the wedge member having lower and upper surfaces that mate with the load shoulders, the wedge member being movable from a radial inner position transmitting a compressive force from the downward facing load shoulder through the wedge member and torque shoulder sleeve to the upward facing torque shoulder of the box, to an outer position relative to the load shoulders, reducing said compressive force;

bias means for urging the wedge member to the outer position; and

retaining means for selectively preventing the wedge member from moving outward to the outer position, and for selectively allowing the wedge member to move to the outer position to allow the body to be easily broken out from the lower tubular member.

2. The torque coupling according to claim **1** wherein both of the downward facing load shoulder of the body and upward facing load shoulder of the torque shoulder sleeve are conical.

3. The torque coupling according to claim **1** wherein the retaining means comprises:

a retaining sleeve mounted to the exterior of the body for axial sliding movement between a locked position and a released position; and

engaging means in the retaining sleeve for pressing radially inward against the wedge member when the retaining sleeve is in the locked position, and for allowing the wedge member to move to the outer position when the retaining sleeve moves to the released position.

4. The torque coupling according to claim **1** wherein the retaining means comprises:

a retaining sleeve mounted to the exterior of the body for vertical sliding movement between a locked position and a released position;

engaging means in the retaining sleeve for pressing radially inward against the wedge member when the retaining sleeve is in the locked position, and for allowing the wedge member to move to the outer position when the retaining sleeve moves to the released position; and wherein

moving the retaining sleeve from the released position to the locked position when the body is threaded to the lower tubular member moves the wedge member back to the inner position to apply a preload force to the upward facing torque shoulder.

5. The torque coupling according to claim **1** wherein the retaining means comprises:

a retaining sleeve mounted to the exterior of the body for vertical sliding movement between a locked position and a released position;

an inclined surface located in the interior of the retaining sleeve, having a large diameter end and a smaller diameter end; and

a plurality of balls in the retaining sleeve between the inclined surface and the wedge member, for pressing radially inward against the wedge member when the retaining sleeve is in the locked position, and for allowing the wedge member to move to the outer position when the retaining sleeve moves to the released position.

6. A torque coupling for connection between upper and lower tubular members, the lower tubular member having an internally threaded box with an upward facing torque shoulder on its upper end, the torque coupling comprising in combination:

a body having a vertical axis and a lower end with an externally threaded pin for connection to the box of the lower tubular member;

connection means on an upper end of the body for connecting the body to the upper tubular member;

a torque shoulder sleeve mounted to the exterior of the body, and having a downward facing torque shoulder for engaging the torque shoulder of the box;

the torque shoulder sleeve having an upper end with an upward facing load shoulder;

the body having a downward facing load shoulder spaced above the load shoulder of the torque shoulder sleeve, at least one of the load shoulders being conical, providing a greater vertical distance between the load shoulder at outer peripheries of the load shoulders than at inner peripheries of the load shoulders;

a wedge member carried between the downward facing load shoulder of the body and the upward facing load shoulder of the torque shoulder sleeve, the wedge member having lower and upper surfaces that mate with the load shoulders, the wedge member being movable from a radial inner position transmitting a compressive force from the downward facing load shoulder through the wedge member and torque shoulder sleeve to the upward facing torque shoulder of the box, to an outer position relative to the load shoulders, reducing said compressive force;

the wedge member being a split ring which is radially compressed when the wedge member is in the inner position; and

retaining means for selectively preventing the wedge member from moving outward to the outer position, and for selectively allowing the wedge member to move to the outer position to allow the body to be easily broken out from the lower tubular member.

7. The torque coupling according to claim **6** wherein both of the downward facing load shoulder of the body and upward facing load shoulder of the torque shoulder sleeve are conical.

8. The torque coupling according to claim **6** wherein the retaining means comprises:

a retaining sleeve mounted to the exterior of the body for vertical sliding movement between a locked position and a released position; and

engaging means in the retaining sleeve for pressing radially inward against the wedge member when the retaining sleeve is in the locked position, and for allowing the wedge member to move to the outer position when the retaining sleeve moves to the released position.

9. The torque coupling according to claim **6** wherein the retaining means comprises:

a retaining sleeve mounted to the exterior of the body for vertical sliding movement between a locked position and a released position;

an inclined surface located in the interior of the retaining sleeve, having a larger diameter end and a smaller diameter end; and

a plurality of balls in the retaining sleeve between the inclined surface and the wedge member, for pressing radially inward against the wedge member when the retaining sleeve is in the locked position, and for allowing the wedge member to move to the outer position when the retaining sleeve moves to the released position, the inclined surface moving relative to the balls when the retaining sleeve moves between the locked and released positions.

10. The torque coupling according to claim **6** wherein the retaining means comprises:

a retaining sleeve mounted to the exterior of the body for vertical sliding movement between a locked position and a released position;

spring means for urging the retaining sleeve to the locked position;

engaging means in the retaining sleeve for pressing radially inward against the wedge member when the retaining sleeve is in the locked position, and for allowing the wedge member to move to the outer position when the retaining sleeve moves to the released position; and wherein

moving the retaining sleeve from the released position to the locked position when the body is threaded to the lower tubular member moves the wedge member back to the inner position to apply a preload force to the upward facing torque shoulder.

11. A torque coupling for connection between upper and lower tubular members, the lower tubular member having an internally threaded box with an upward facing torque shoulder on its upper end, the torque coupling comprising in combination:

a body having a vertical axis and a lower end with an externally threaded pin for connection to the box of the lower tubular member;

connection means on an upper end of the body for connecting the body to the upper tubular member;

a torque shoulder sleeve slideably mounted to the exterior of the body and having a downward facing torque shoulder for engaging the torque shoulder of the box;

the torque shoulder sleeve having an upper end with an upward facing load shoulder;

the body having a downward facing load shoulder spaced above the load shoulder of the torque shoulder sleeve, each of the load shoulders being inclined relative to the axis of the body, providing a greater vertical distance between the load shoulders at outer peripheries of the load shoulders than at inner peripheries of the load shoulders;

a wedge member carried between the downward facing load shoulder of the body and the upward facing load shoulder of the torque shoulder sleeve, the wedge member having lower and upper surfaces that mate with the load shoulders, the wedge member being movable from a radial inner position transmitting a compressive force from the downward facing load shoulder through the wedge member and torque shoulder sleeve to the upward facing torque shoulder of the box, to an outer position relative to the load shoulders, reducing said compressive force;

the wedge member being a split ring which is radially compressed when the wedge member is in the inner position;

a retaining sleeve mounted to the exterior of the body for vertical sliding movement between an upper locked position and a lower released position;

spring means mounted between the retaining sleeve and the body for urging the retaining sleeve upward;

an inclined surface located in the interior of the retaining sleeve, having a large diameter upper end and a smaller diameter lower end;

a plurality of vertically extending grooves located on the inclined surface;

a plurality of concave recesses located on an outer side of the wedge member opposite the grooves;

a plurality of balls in the retaining sleeve carried in the grooves and recesses between the inclined surface and the wedge member, for pressing radially inward against the wedge member when the retaining sleeve is in the locked position, and for allowing the wedge member to move to the outer position when the retaining sleeve moves to the released position, the grooves moving downward relative to the balls when the retaining sleeve moves downward.

12. The torque coupling according to claim **11**, wherein:

moving the retaining sleeve upward from the released position to the locked position when the body is initially threaded to the lower tubular member moves the wedge member back to the inner position to apply a preload force to the upward facing torque shoulder, allowing the body to be made up initially to the lower tubular member at less than desired make up torque.

13. A method for making up and braking out a connection between upper and lower tubular members, the lower tubular member having an internally threaded box with an upward facing torque shoulder on its upper end, comprising in combination:

providing a torque coupling comprising:

a body having a vertical axis and a lower end with an externally threaded pin;

a torque shoulder sleeve mounted to the exterior of the body and having a downward facing torque shoulder for engaging the torque shoulder of the box;

the torque shoulder sleeve having an upper end with an upward facing load shoulder;

the body having a downward facing load shoulder spaced above the load shoulder of the torque shoulder sleeve, at least one of the load shoulders being conical, providing a greater vertical distance between the load shoulders at outer peripheries of the load shoulders than at inner peripheries of the load shoulders;

a wedge member carried between the downward facing load shoulder of the body and the upward facing load shoulder of the torque shoulder sleeve, the wedge member having lower and upper surfaces that mate with the load shoulders, the wedge member being movable from a radial inner position transmitting a compressive force from the downward facing load shoulder through the wedge member and torque shoulder sleeve to the upward facing torque shoulder of the box, to an outer position relative to the load shoulders, reducing said compressive force;

connecting the upper end of the body to the upper tubular member;

connecting the pin of the body to the box of the lower tubular member by rotating the body and lower tubular member relative to each other while the wedge member is in the outer position until the torque shoulders contact each other; then

moving the wedge member to the inner position, applying a compressive load through the torque shoulder sleeve to the upward facing load shoulder of the box to increase the compressive load between the torque shoulders to the desired make up load; then, to break out the connection,

moving the wedge member back to the outer position, releasing the compressive load in the torque shoulder sleeve and between the torque shoulders; then

rotating the body and the lower tubular member relative to each other to unscrew the body and the lower tubular member from each other.

14. A torque coupling for connection between upper and lower tubular members, the lower tubular member having an internally threaded box with an upward facing torque shoulder on its upper end, the torque coupling comprising in combination:

a body having a vertical axis and a lower end with an externally threaded pin for connection to the box of the lower tubular member;

connection means on an upper end of the body for connecting the body to the upper tubular member; p1 a torque shoulder sleeve mounted to the exterior of the body and having a downward facing torque shoulder for engaging the torque shoulder of the box;

the torque shoulder sleeve having an upper end with an upward facing conical load shoulder;

the body having a downward facing conical load shoulder spaced above the load shoulder of the torque shoulder sleeve, at least one of the load shoulders being conical, providing a greater vertical distance between the load shoulders at outer peripheries of the load shoulders than at inner peripheries of the load shoulders;

a wedge member carried between the downward facing conical load shoulder of the body and the upwardly facing conical load shoulder of the torque shoulder sleeve, the wedge member having lower and upper surfaces that mate with the load shoulders, the wedge member being movable from a radial inner position transmitting a compressive force from the upper load shoulder through the wedge member and torque shoulder sleeve to the upward facing torque shoulder of the box, to an outer position relative to the load shoulders, reducing said compressive force;

bias means for urging the wedge member to the outer position; and

retaining means for selectively preventing the wedge member from moving outward to the outer position, and for selectively allowing the wedge member to move to the outer position to allow the body to be easily broken out from the lower tubular member, wherein said retaining means includes:

a retaining sleeve mounted to the exterior of the body for axial sliding movement between a locked position and a released position; and

engaging means in the retaining sleeve for pressing radially inward against the wedge member when the retaining sleeve is in the locked position, and for allowing the wedge member to move to the outer position when the retaining sleeve moves to the released position.

15. The torque coupling according to claim **14**, wherein:

moving the retaining sleeve from the released position to the locked position when the body is threaded to the lower tubular member moves the wedge member back to the inner position to apply a preload force to the upward facing torque shoulder.

16. The torque coupling according to claim **14**, wherein the retaining means further comprises:

an inclined surface located in the interior of the retaining sleeve, having a larger diameter end and a smaller diameter end; and

a plurality of balls in the retaining sleeve between the inclined surface and the wedge member, for pressing radially inward against the wedge member when the retaining sleeve is in the locked position, and for allowing the wedge member to move to the outer position when the retaining sleeve moves to the released position.

17. A torque coupling for connection between upper and lower tubular members, the lower tubular member having an internally threaded box with an upward facing torque shoulder on its upper end, the torque coupling comprising in combination:

a body having a vertical axis and a lower end with an externally threaded pin for connection to the box of the lower tubular member;

connection means on an upper end of the body for connecting the body to the upper tubular member;

a torque shoulder sleeve mounted to the exterior of the body, and having a downward facing torque shoulder for engaging the torque shoulder of the box;

a torque shoulder sleeve having an upper end with an upward facing conical load shoulder;

the body having a downward facing conical load shoulder spaced above the load shoulder of the torque shoulder sleeve, at least one of the load shoulders being conical, providing a greater vertical distance between the load shoulders at outer peripheries of the load shoulders than at inner peripheries of the load shoulders;

a wedge member carried between the downward facing conical load shoulder of the body and the upward facing conical load shoulder of the torque shoulder sleeve, the wedge member having lower and upper surfaces that mate with the load shoulders, the wedge member being movable from a radial inner position transmitting a compressive force from the upper load shoulder through the wedge member and torque shoulder sleeve to the upward facing torque shoulder of the box, to an outer position relative to the load shoulders, reducing said compressive force;

the wedge member being a split ring which is radially compressed when the wedge member is in the inner position;

retaining means for selectively preventing the wedge member from moving outward to the outer position, and for selectively allowing the wedge member to move to the outer position to allow the body to be easily broken out from the lower tubular member, wherein said retaining means includes:

a retaining sleeve mounted to the exterior of the body for vertical sliding movement between a locked position and a released position; and

engaging means in the retaining sleeve for pressing radially inward against the wedge member when the retaining sleeve is in the locked position, and for allowing the wedge member to move to the outer position when the retaining sleeve moves to the released position.

18. The torque coupling according to claim **17**, wherein the retaining means further comprises:

an inclined surface located in the interior of the retaining sleeve, having a larger diameter end and a smaller diameter end; and

a plurality of balls in the retaining sleeve between the inclined surface and the wedge member, for pressing radially inward against the wedge member when the retaining sleeve is in the locked position, and for allowing the wedge member to move to the outer position when the retaining sleeve moves to the released position, the inclined surface moving relative to the balls when the retaining sleeve moves between the locked and released positions.

19. The torque coupling according to claim **17**, wherein the retaining means further comprises:

spring means for urging the retaining sleeve to the locked position; wherein

moving the retaining sleeve from the released position to the locked position when the body is threaded to the lower tubular member moves the wedge member back to the inner position to apply a preload force to the upward facing torque shoulder.

20. A torque coupling for connection between upper and lower tubular members, the lower tubular member having an internally threaded box with an upward facing torque shoulder on its upper end, the torque coupling comprising in combination:

a body having a vertical axis and a lower end with an externally threaded pin for connection to the box of the lower tubular member;

connection means on an upper end of the body for connecting the body to the upper tubular member;

a torque shoulder sleeve slideably mounted to the exterior of the body and having a downward facing torque shoulder for engaging the torque shoulder of the box;

the torque shoulder sleeve having an upper end with an upward facing load shoulder;

the body having a downward facing load shoulder spaced above the load shoulder of the torque shoulder sleeve, each of the load shoulders being inclined relative to the axis of the body, providing a greater vertical distance between the load shoulders at inner peripheries of the load shoulders than at outer peripheries of the load shoulders;

a wedge member carried between the load shoulders, the wedge member having lower and upper surfaces that mate with the load shoulders, the wedge member being movable from a radial inner position transmitting a compressive force from the upper load shoulder through the wedge member and torque shoulder sleeve to the upward facing torque shoulder of the box, to an outer position relative to the load shoulders, reducing said compressive force;

the wedge member being a split ring which is radially compressed when the wedge member is in the inner position;

a retaining sleeve mounted to the exterior of the body for vertical sliding movement between an upper locked position and a lower released position;

spring means mounted between the retaining sleeve and the body for urging the retaining sleeve upward;

an inclined surface located in the interior of the retaining sleeve, having a larger diameter upper end and a smaller diameter lower end;

a plurality of vertically extending grooves located on the inclined surface;

a plurality of concave recesses located on an outer side of the wedge member opposite the grooves;

a plurality of balls in the retaining sleeve carried in the grooves and recesses between the inclined surface and the wedge member, for pressing radially inward against the wedge member when the retaining sleeve is in the locked position, and for allowing the wedge member to move to the outer position when the retaining sleeve moves to the released position, the grooves moving downward relative to the balls when the retaining sleeve moves downward, wherein:

moving the retaining sleeve upward from the released position to the locked position when the body is initially threaded to the lower tubular member moves the wedge member back to the inner position to apply a preload force to the upward facing torque shoulder, allowing the body to be made up initially to the lower tubular member at less than desired make up torque.

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